

What is claimed is:

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1. A method for producing and delivering protein in vivo comprising the steps of:
- (a) inserting a promoter and a gene encoding a protein in a vector;
  - (b) collecting an amount of host cells from a mammal;
  - (c) treating host cells in vitro with said vector;
  - (d) introducing the treated host cells back to said mammal, wherein the treated host cells produce red blood cells and said protein in vivo in said mammal, and wherein said protein is contained only in said red blood cells, and thereafter said protein is released into blood stream of said mammal through rupture of said red blood cells.
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2. The method of Claim 1 further comprising inserting an enhancer in said vector.
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3. The method of Claim 1 wherein said promoter is a natural promoter.
4. The method of Claim 1 wherein said promoter is a mutated promoter.
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5. The method of Claim 1 wherein said promoter is a non-hemoglobin promoter native to red blood cells.
6. The method of Claim 1 wherein said vector is a viral vector.
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7. The method of Claim 6 wherein said viral vector is selected from the group consisting of a retroviral vector, an adenoviral vector, and a lentiviral vector.
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8. The method of Claim 1 wherein said host cells are stem cells, and progenitor cells of said red blood cells.
9. The method of Claim 1 wherein the rupture of said red blood cells is

an in vivo process.

Sub Q3  
10. The method of Claim 11 wherein the rupture of said red blood cells is an induced process in vivo.

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11. The method of Claim 1 wherein said protein is a member selected from the group consisting of an antibody, enzyme, cofactor, interferon, and hormone.

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12. The method of Claim 1 wherein said protein is a peptide.

Sub Q1  
13. The method of any one of Claim 11-12 wherein said protein is a naturally occurred protein.

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14. The method of any one of Claim 11-12 wherein said protein is a fusion protein.

Sub Q11  
15. The method of any one of Claim 11-12 wherein said protein is a mutated protein.

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16. A method for producing and delivering protein in vivo comprising the steps of:

Sub Q3  
(a) inserting a hemoglobin promoter and a gene encoding a non-hemoglobin protein in a vector;

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(b) collecting an amount of host cells from a mammal;

(c) treating host cells in vitro with said vector;

(d) introducing the treated host cells back to said mammal, wherein the treated host cells produce red blood cells and said protein in vivo in said mammal, and wherein said protein is contained only in said red blood cells, and thereafter said protein is released into blood stream of said mammal through rupture of said red blood cells.

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17. The method of Claim 16 further comprising inserting an enhancer in said vector.

18. The method of Claim 16 wherein said hemoglobin promoter is a natural promoter.

19. The method of Claim 16 wherein said hemoglobin promoter is a mutated promoter.

20. The method of Claim 16 wherein said vector is a viral vector.

21. The method of Claim 20 wherein said viral vector is selected from the group consisting of a retroviral vector, an adenoviral vector, and a lentiviral vector.

22. The method of Claim 16 wherein said host cells are stem cells, and progenitor cells of said red blood cells.

23. The method of Claim 16 wherein the rupture of said red blood cells is an in vivo process.

24. The method of Claim 23 wherein the rupture of said red blood cells is an induced process in vivo.

25. The method of Claim 16 wherein said protein is a member selected from the group consisting of an antibody, enzyme, cofactor, interferon, and hormone.

26. The method of Claim 16 wherein said protein is a peptide.

27. The method of any one of Claim 25-26 wherein said protein is a naturally occurred protein.

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28. The method of any one of Claim 25-26 wherein said protein is a fusion protein.

5 29. The method of any one of Claim 25-26 wherein said protein is a mutated protein.

30. A protein produced and delivered in vivo by a process, wherein the process comprising the steps of:

- 10 (a) inserting a hemoglobin promoter and a gene encoding a non-hemoglobin protein in a vector;
- (b) collecting an amount of host cells from a mammal;
- (c) treating host cells in vitro with said vector;
- (d) introducing the treated host cells back to said mammal, wherein the
- 15 treated host cells produce red blood cells and said protein in vivo in said mammal, and wherein said protein is contained only in said red blood cells, and thereafter said protein is released into blood stream of said mammal through rupture of said red blood cells.

20 31. The method of Claim 30 further comprising inserting an enhancer in said vector.

32. The method of Claim 30 wherein said hemoglobin promoter is a natural promoter.

25 33. The method of Claim 30 wherein said hemoglobin promoter is a mutated promoter.

34. The method of Claim 30 wherein said vector is a viral vector.

30 35. The method of Claim 34 wherein said viral vector is selected from the group consisting of a retroviral vector, an adenoviral vector, and a lentiviral

vector.

36. The method of Claim 30 wherein said host cells are stem cells, and progenitor cells of said red blood cells.

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37. The method of Claim 30 wherein the rupture of said red blood cells is an in vivo process.

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38. The method of Claim 37 wherein the rupture of said red blood cells is an induced process in vivo.

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39. The method of Claim 30 wherein said protein is a member selected from the group consisting of an antibody, enzyme, cofactor, interferon, and hormone.

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40. The method of Claim 30 wherein said protein is a peptide.

41. The method of any one of Claim 39-40 wherein said protein is a naturally occurred protein.

42. The method of any one of Claim 39-40 wherein said protein is a fusion protein.

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43. The method of any one of Claim 39-40 wherein said protein is a mutated protein.